PASSENGER RAIL CORRIDOR STUDY
Tucson to Phoenix

Passenger Rail Corridor Study
Tucson to Phoenix

RIDERSHIP MODELING PLAN TECHNICAL MEMORANDUM

Submitted by:

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Submitted to:

Federal Transit Administration
Federal Rail Administration

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Table of Contents

1.0 Introduction

This memorandum presents a brief description of the proposed plan for conducting ridership analysis for the Tucson to Phoenix Passenger Rail Corridor Study (APRCS). A more detailed report describing the next generation of the Arizona Statewide Travel Demand Model (AZTDM) and its application to this study will be produced at a later date when all the planned model enhancements and refinements to the model are completed. It is anticipated that a fully functioning AZTDM model with a mode choice component will be completed by the end of summer 2012.

2.0 Arizona Statewide Travel Demand Model

AZTDM is a network-based model and was originally developed in 2009. The first version (AZTDM-1) of the model consisted of three modeling steps: trip generation, distribution, and auto assignment and utilized 1,098 zones to represent the entire state of Arizona. The highway network used in the model was relatively coarse, consisting of major highways and expressways only. The urban areas were not modeled in detail. The trip generation rates used in the model were imported from other areas and as such, did not capture the specific characteristics of the state. The second generation of the AZTDM model (known as AZTDM-2) contains a highly disaggregated zone system (6,000 zones) and a detailed highway network in both urban and non-urban areas. It uses data from the National Household Travel Survey to generate state specific trip generation rates. The model, however, still does not contain a transit mode choice model. Currently, the transit share is estimated using a set of pre-determined mode splits by area type and trip purpose. The third version (AZTDM-3) is currently under development and is expected to be completed by the end of summer 2012. This version would contain a fully functioning mode choice model that is designed to test and evaluate the ridership impacts of alternative transit networks.

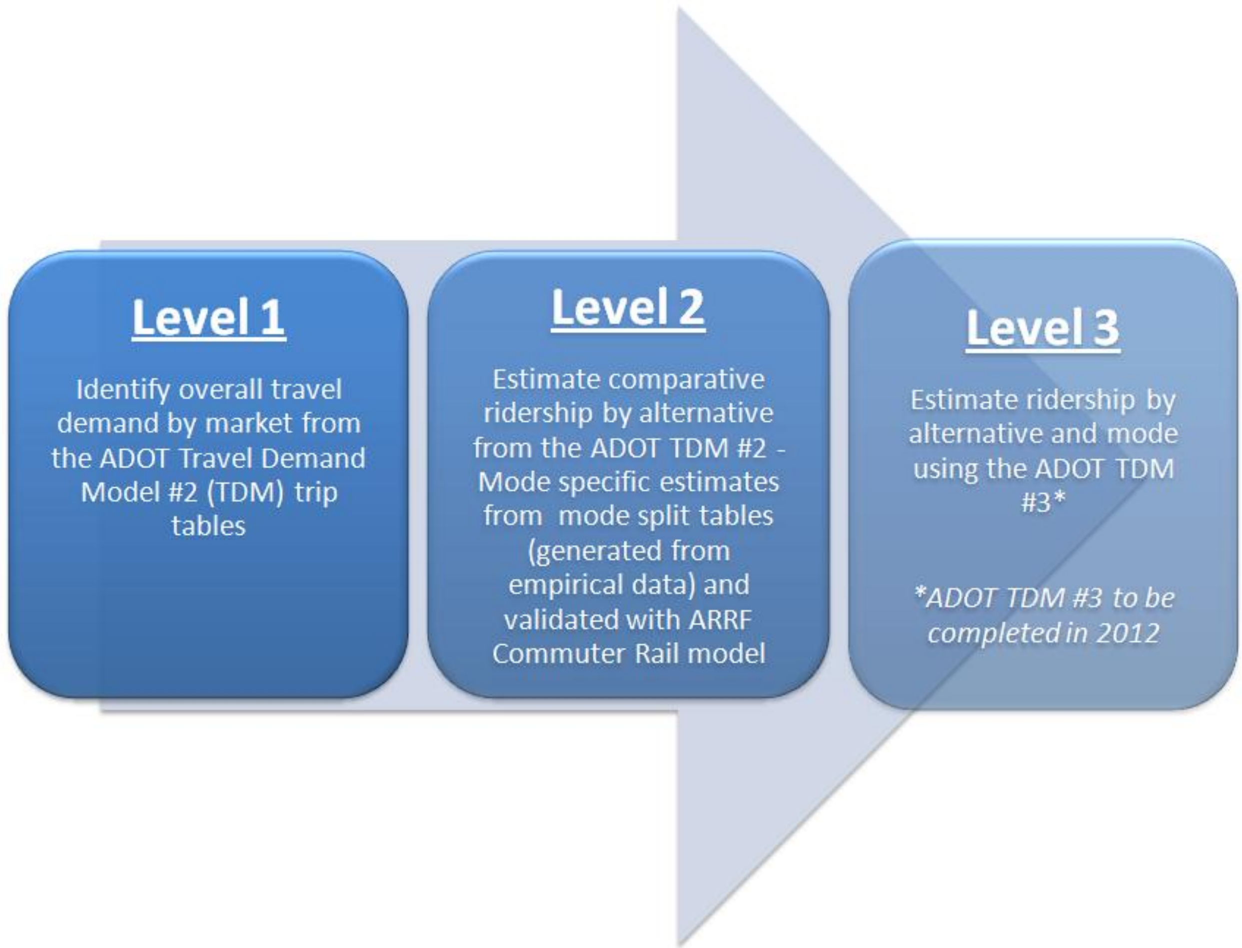
3.0 Proposed Ridership Forecasting Plan

Since AZTDM-3 is not expected to be available until late summer 2012, an alternative, multi-level approach for estimating travel demand and transit ridership is being proposed for this study. Each level has been identified to provide appropriate results for each stage of the alternatives analysis process. **Figure 1** provides a summary of the three levels of travel demand/ridership forecasting proposed for this study, while a more detailed description is provided below.

3.1 Level 1 Demand Assessment

The purpose of Level 1 is to identify overall travel demand by market. A sketch planning approach will be applied to develop travel demand projections for the initial evaluation of alternatives. This methodology will draw upon the outputs produced by the AZTDM-2 model (such as person trips, highway skims) to identify relative levels of travel demand by market within the study corridor and within potential alternative alignments.

Figure 1: Travel Demand/Ridership Forecasting Process



3.2 Level 2 Demand Assessment

Using the AZTDM-2 model, the Level 2 process will provide estimates of comparative ridership by alternative to measure the relative difference between each. The first step in this process involves compiling empirical mode share data. This will be done by conducting research on fully matured, functioning rail systems in the country and collecting information on: 1) all the factors that influence their rail ridership and 2) their current rail mode splits. Some of this information will be compiled from the data that were used to develop the ARRF (Aggregate Rail Ridership Forecasting) model.

FTA is currently in the process of updating the ARRF model using newer rail data. The study team has already obtained the ARRF data from FTA and is in the process of analyzing them. The study team also plans to supplement those data by collecting additional data from newer systems such as Dallas-Fort Worth, Minneapolis, and Salt Lake City. To date, the following data have been collected for 17 rail and 6 bus systems in North America. Appendix A shows a table containing a sample of the data that that has already been collected.

- Origin/destination points
- Trip time, travel cost
- Year service began
- One-way route mile
- Number of stations
- CBD connectivity (per FTA's suggestion)
- End of line station location (as per FTA's suggestion)
- Connectivity to HCT and local routes
- Weekday/weekend level of service
- Access options at destination end (bus, taxi, subway, LRT, etc.)
- Availability of free parking at origin end
- Parallel Interstate or highway
- Average daily and peak traffic volumes on parallel highways

Corridor-specific rail mode shares for each system will be obtained directly from the operators or the MPOs. In such cases where the mode share data are not readily available, the study team will attempt to estimate them using the person trips on the parallel highways (estimated from traffic volumes). Once the mode share data for all the rail systems in the transit database have been compiled, a lookup table of intercity and commuter mode shares classified by area type, distance of travel, rail technology (commuter rail and intercity passenger rail), CBD connectivity[1], and size of cities served will be developed. In addition, a subset of the data limited to newer western commuter/intercity rail services (Minneapolis, Dallas-Ft Worth, Salt Lake City, etc.) is being reviewed to determine the variance among all systems that data were collected for. Since bus mode is one of the alternatives that will be considered in the study, data has also been collected for intercity bus systems including services providing connections to Minneapolis, El Paso, New Orleans, and Phoenix. Depending on the amount of data that is available for the bus mode, mode split look-up tables cross-classified by trip distance and service type will be developed. After identifying the key characteristics of the proposed rail alternatives (end of line station, CBD connectivity, length of route, station locations, service levels, etc), appropriate mode shares will be applied to the person trips (obtained from AZTDM-2) in the analysis districts to estimate transit demand for commuter and intercity rail options. A similar approach will be used to generate ridership on the bus alternatives. As per FTA's recommendation, ridership will be estimated for opening year as well as a long term forecast year (2035).

Figure 2 illustrates the different steps involved in the Level 2 approach. The first step is to analyze the outputs created by the AZTDM-2 model and compile the person trip flows, highway travel times, level of service data (for example, volume/capacity ratios) during peak and non-peak periods for the study area in the forecast year. Next, for each alternative that will be considered for screening purposes, a market area will be delineated along the alignment using land use, current highway and transit accessibility, and professional judgment. Once the market area has been delineated, it will be divided into convenient

[1] ARRF model incorporates a CBD Connectivity factors in the estimation of rail ridership. The sensitivity of that factor to rail ridership will be analyzed and incorporated in the development of the look-up tables for mode shares.

analysis districts using area type, city boundaries and land use. The person trip flows and travel time data collected in the first step will be aggregated to the analysis districts. Appropriate mode shares will be applied to the person trips to estimate the potential ridership by mode (bus, commuter rail and intercity passenger rail).

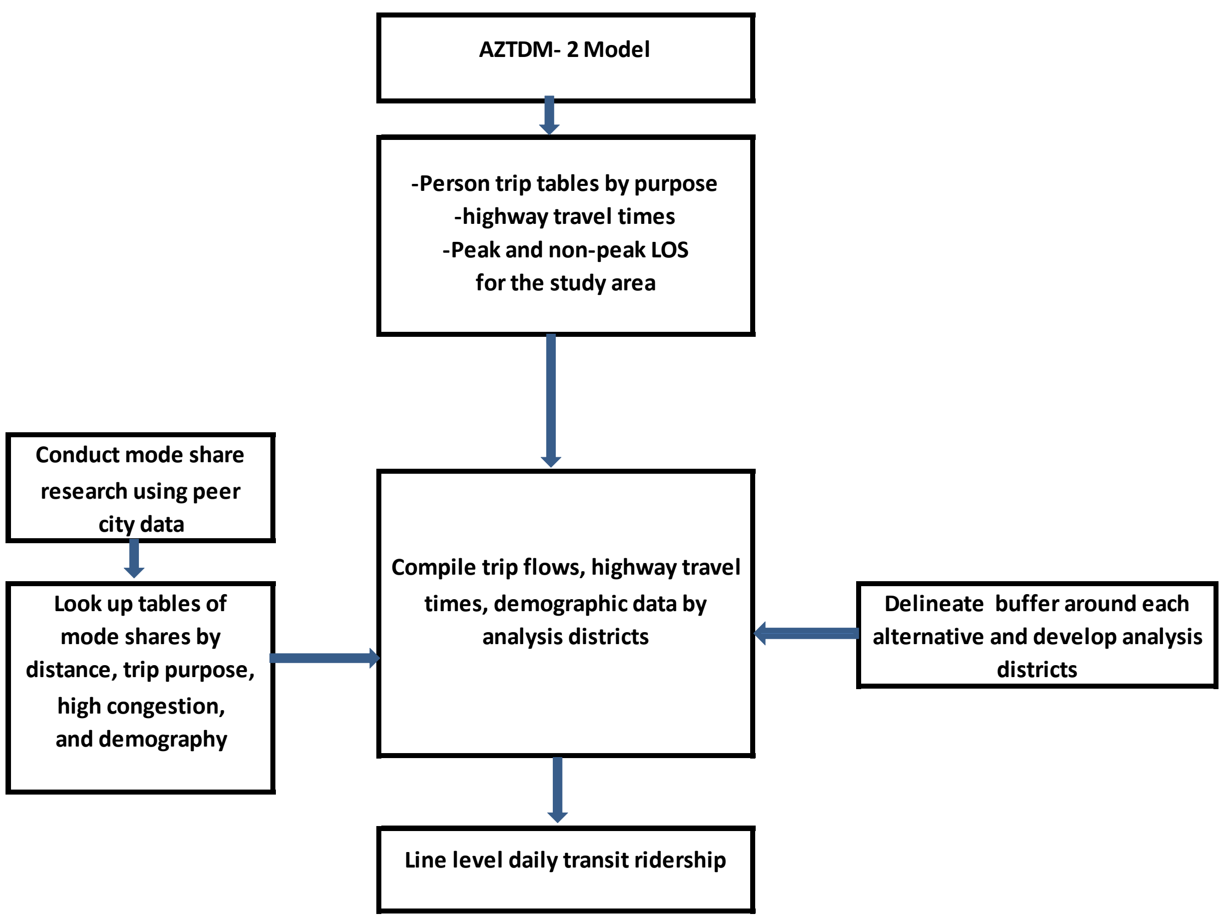
Inputs

- Rail mode shares based on peer system rail data
- Person trips in the corridor from AZTDM-2 model
- Operational characteristics of the proposed alternative (route length, end of line stations, CBD connectivity, service levels, trip time, cost, etc.)

Output:

- Line level ridership for intercity and urban commute travel

Figure 2: Hybrid Approach to Estimate Ridership (for screening alternatives) Level 2



3.3 Level 3 Demand Assessment

The ridership projections for the final set of alternatives will be developed using the final version of the third generation AZTDM-3 model. The final version would contain a fully functioning mode choice model. It is assumed that there will be up to three build alternatives and one Baseline alternative in addition to a No-Build alternative.

3.3.1 No-Build Alternative

A No-Build Alternative is required by NEPA to be part of the study process. It includes all transportation facilities and services programmed for implementation within the APRCS study area. This alternative includes roadway and highway improvements identified in the Transportation Improvement Programs (TIPs) of the MAG, Central Arizona Association of Governments (CAAG), and PAG, but no additional significant improvements. Programmed improvements include:

- Interstate 10: Construction of local express lanes between 32nd Street and Loop 202.
- Interstate 10: Roadway widening from four to six general purpose lanes and the addition of an HOV lane from Loop 202 to Riggs Road.
- Interstate 10: Roadway widening and lane additions between Florence Boulevard and State Route 87.
- Interstate 10: Roadway widening from six to eight lanes between Ina Road and Prince Road.
- Interstate 19: Roadway widening from four to eight lanes between San Xavier Road and Interstate 10.
- State Route 77: Roadway widening from four to six lanes between Tangerine Road and the Pima County line.
- Maricopa-Casa Grande Highway: Roadway widening from two to four lanes between State Route 84 and State Route 347.

3.3.2 Baseline Alternative

A Baseline Alternative includes all programmed transportation facilities and service improvements included in the No-Build Alternative, as well as transportation system management (TSM) enhancements. TSM would include relatively low-cost safety, operational, and capacity enhancements to the existing transportation system. This alternative would not include a major guideway investment and would represent a less-capital intensive improvement strategy to address project goals within the study area. The Baseline Alternative would be mainly focused on increased bus service and selected facility improvements, and serves as the basis of performance comparison in the Federal Transportation Administration's (FTA) "New Starts" grant process.

3.3.3 Ridership Forecasting

The mode choice model that is currently being implemented in version 3 has only one transit mode. As such, it is not set up to distinguish the unique attractiveness associated with a rail alternative from a bus alternative. Therefore, the mode choice model will be able to differentiate the bus and rail alternatives only on the basis of their level of service characteristics such as travel speeds, frequencies, fares, access and intermodal connectivities. The project team will initiate discussions with FTA to explore possible options to include off-model credits for rail alternatives to account for the rail bias effect on ridership.

Inputs

- Socio-economic data (HHsize, income, workers)
- Highway network attributes (lanes, speeds, capacity, classification)
- Transit network attributes (modes, level of service, fares, travel times, capacity)
- Employment data (by employment type)
- Other (auto operating costs, parking costs)

Outputs

- Trip tables by mode
- Congested travel times on highway by time of day
- Traffic volumes by time of day
- Transit assignment results

Model runs will be conducted for each build alternative, with the output results analyzed in detail and summarized in tabular form. The results will include system-wide ridership statistics, regional and corridor mode shares by trip purpose, boardings by station, average trip lengths, vehicle miles traveled, vehicle hours traveled, and estimates of emissions. Ridership estimates will be distinguished by commuter rail service and inter-city rail service. The project's definition for commuter rail and intercity rail are provided in Table 1.

Table 1: Commuter Rail and Intercity Rail Definition

Service	Description	Characteristics
Commuter Rail	• Short-haul rail passenger transportation generally connecting a central city and outlying communities • Predominantly commuter service: more than 50% of the average daily ridership on a segment travels on the service at least three times per week • Most commuter stations would be considered local stations. Commuter rail service would stop at all stations in the corridor subject to demand/ operational needs.	• **Stations**: – Generally 5 - 10 miles apart – Serve suburban locations – Usually there are only one or two stations in the central city • **Fare:** Lower fare compared to intercity service • **Tickets:** Multiple ride and commuter • **Operations:** Morning and evening peak period
Intercity Rail	• Long-haul scheduled service between major metropolitan areas or major activities centers • Trains originate and terminate at stations at the far ends of the system (i.e., Terminal stations), and stop at Regional stations only.	• **Stations**: – Generally 5 - 10 miles apart – Serve suburban locations – Usually there are only one or two stations in the central city • **Fare:** Lower fare compared to intercity service • **Tickets:** Multiple ride and commuter • **Operations:** Morning and evening peak period

4.0 Plan for Quality Control/Reasonableness Testing

In order to ensure the projected ridership for the proposed alternatives is realistic and reasonable, the study team will conduct a series of tests. For the Level 2 analysis, the first test would be to determine if the trip flows among different analysis districts within the corridor are reasonable. The study team will use a combination of 2009 LEHD and 2000 CTPP data to compare the distribution of trips from the model and identify district interchanges where significant differences exist between the modeled trips and observed data. The study team is also exploring the possibility of obtaining actual trip distribution data from a company called AirSage. AirSage has the capability to generate the trip interchange data in the corridor directly from their database of cell phone records. Since the study team will be employing peer city mode splits for the Level 2 analysis, there will not be any need to estimate corridor level mode splits for comparison and evaluation. However, for the Level 3 analysis, the study team will compute the following statistics and compare them with other peer cities for reasonableness:

- Corridor mode split for rail mode (intercity versus commuter)
- Boardings per route mile
- Peak versus off-peak boardings
- Short trips: Work versus non-work trips
- Long trips: Business versus recreation trips
- Boardings by mode of access
- Average trip lengths for commute and intercity trips
- Average travel times

To supplement and verify the Level 2 demand forecasts, the Aggregate Rail Ridership Forecasting model (ARRF) will be applied to a limited selection of potentially viable alternatives and produce line level demand forecasts. In addition, the study team understands that the FRA is developing intercity travel demand sketch planning tools for use on the Southwest Rail Plan. The tools should be available by the Summer of 2012 for use by state agencies and MPOs. To the extent feasible, the study team will use those tools to compare and validate results of the travel demand modeling processes currently proposed.

4.1 Addressing Uncertainties

When forecasting for the medium to long term (20 to 30 years), it is important to acknowledge that the future is uncertain. There are a number of factors which may contribute to errors and uncertainty in travel forecasts. Some of the errors can be reduced by adopting good modeling practices; however, they are extremely difficult to eliminate. In the Level 3 ridership analysis, the study team will address uncertainties in travel forecasts to the extent possible.

Sources of uncertainty and errors in travel models include the following:

- Uncertainties associated with major input assumptions (such as demographic and land use forecasts and transportation networks);
- Uncertainties associated with a project’s service and operations plan; and,
- Uncertainties associated with limitations of regional models.

4.1.1 Demographic and Land Use Forecasts

Since it is very difficult to forecast birth rates, death rates, in-migration and out-migration rates with a high level of accuracy, it follows that there will always be some uncertainty associated with demographic forecasts; however, they can be minimized through the use of robust and realistic growth assumptions and rigorous demographic analysis. Demographic forecasts are the most fundamental input to the travel model. If major errors are introduced in this step, they will get propagated through the rest of the modeling process and lead to serious under-estimation or over-estimation problems. In order to understand what impacts the uncertainties in demographic forecasts have on projected ridership, the study team plans to conduct several sensitivity model runs by varying the assumptions on future demographic growth. For example, one option would be to reduce the entire person trip table by 15 percent (i.e., assuming only 85 % of the projected growth would take place by forecast year), conduct a model run and estimate ridership. Similarly, another scenario would be tested in which the future growth assumed to be 10 % more than what is currently being projected.

4.1.2 Transportation Networks

In travel modeling, the physical characteristics of the transportation network can be represented only approximately. Certain characteristics such as the attractiveness of a mode, comfort, ride quality, safety etc. cannot readily be quantified for use in a mathematical forecast model. Therefore, estimates of some input data such as roadway capacity, free flow speeds, transit access characteristics, average transit speeds etc. have some margin of error associated with them. Also, there is a level of uncertainty associated with forecast year project assumptions. Some projects may or may not be completed by the forecast year. Travel models may contain measurement errors which relate to inaccurate input data. For example, forecasts of fuel prices, downtown parking costs, and levels of economic activity may all have some level of uncertainty associated with them. Once the AZTDM-3 model is completed, the study team will discuss with FTA and FRA staff and identify a set of model variables for further sensitivity testing. The results of the sensitivity testing will help us quantify some of the uncertainty associated with ridership estimates. The results would also help us establish a range of possible variation associated with the ridership forecasts.

4.1.3 Project's Service and Operation Plan

The ridership forecasts developed during the planning stage of a project are based on a broad conceptual plan. As such, the exact alignment, station locations, access configurations, operating characteristics, usually do not get finalized until the final stages. When these parameters get refined during the preliminary engineering and final design, it is possible the actual operating plan could be different from the one assumed in initial forecasting. Based on this possibility, there is some uncertainty associated with specifics of the project being modeled.

4.1.4 Limitation of Regional Travel Models

Travel modeling is not an exact science. Inaccurate assumptions made during the model building stage, as well as inaccurate model formulation may lead to specification errors. These errors relate to the fact that models are only an approximation of reality. The study team will attempt to minimize the errors by ensuring that the model is well calibrated and validated within the bounds of data availability, resources, and schedule. To that effect, the team will provide technical guidance and support, if needed, to ADOT in their model calibration and validation process.

The final ridership projections will be presented in ranges rather than a single number for an estimated opening year date in 2025. Ridership projections will be further segregated into intercity versus commute trips. The lower-bound estimate of the range will be based on conservative demographic and level of service assumptions and the upper-bound will be based on optimistic assumptions. The demographic data ranges used to develop the upper and lower bounds of the ridership estimation range will be sourced from the Arizona State Demographer's official demographic data ranges.

APPENDIX A: Sample Data Collected

Sample of Commuter Rail/Intercity Rai/Intercity Bus Data Collected – Transit Systems
(Data collection is in progress)

Owner/Manager	Operator	System	Metropolitan Area	State/ Province	Country	Train\Bus Line	From	To	Travel to CBD?	Connect to HCT?	Connect to Local Routes?
COMMUTER RAIL SERVICES											
Denton County Transportation Authority	Denton County Transportation Authority	A-train	Denton	TX	US	A-train	Denton DT TC	Trinity Mills	No	Yes-LRT	Yes-Bus
Capital Metropolitan Transportation Authority	Capital Metropolitan Transportation Authority	Capital MetroRail	Austin	TX	US	Red Line	Leander	Downtown Austin	Yes	No	Yes-Bus
Utah Transit Authority	Utah Transit Authority	FrontRunner	Salt Lake City-Ogden	UT	US	FrontRunner	Ogden	Salt Lake Central Station	Yes	Yes-LRT	Yes-Bus
Tennessee Department of Transportation	Tennessee Regional Transportation Authority	Music City Star	Nashville	TN	US	East Corridor Line	Lebanon	Nashville Riverfront Station	Yes	No	Yes-Bus
North County Transit District	TransitAmerica Services	Coaster	San Diego	CA	US	Coaster	Oceanside	Downtown San Diego	Yes	Yes-LRT	Yes-Bus
NMDOT & Mid Region Council of Governments	Herzog Transit Services	New Mexico Rail Runner Express	Albuquerque	NM	US	RailRunner	Santa Fe Depot	Belen	Yes	Yes-BRT	Yes-Bus
Metropolitan Council (Rolling Stock) / BNSF (Infrastructure)	Metropolitan Council (Staff) / BNSF (Locomotives	Northstar Commuter Rail	Minneapolis-St. Paul	MN	US	Northstar Line	Big Lake	Target Field	Yes	Yes-LRT	Yes-Bus
Dallas Area Rapid Transit & Ft. Worth Transportation Authority	Herzog Transit Services	Trinity Railway Express	Dallas-Ft. Worth Metroplex	TX	US	Trinity Railway Express	T&P Station, Ft. Worth	Dallas Union Station	Yes	Yes-LRT	Yes-Bus
Tri-County Metropolitan Transportation District of Oregon (TriM	Portland & Western Railroad	Westside Express Service	Portland	OR	US	Westside Express Service	Wilsonville	Beaverton	No	Yes-LRT	Yes-Bus
INTERCITY BUS SERVICES											
New Mexico Department of Transportation	New Mexico Department of Transportation	New Mexico Park-and-Ride	El Paso	TX/NM	US	Gold Line	Las Cruces, NM	El Paso, TX	Yes	No	Yes-Bus
Jefferson Lines	Jefferson Lines	Private	Minneapolis	MN	US	Routes 909/910	Duluth	Minneapolis	Yes	Yes	Yes-Bus
Department of Transportation and Development	Department of Transportation and Development	LA Swift	New Orleans	LA	US	LA Swift	Baton Rouge	New Orleans	Yes	No	Yes-Bus
Route 685	Regional Public Transportation Authority (RPTA)	Valley Metro	Phoenix	AZ	US	Route 685 -Ajo\Gila Bend Connector	Buckeye	Phoenix	No	No	Yes-Bus
Route 685	Regional Public Transportation Authority (RPTA)	Valley Metro	Phoenix	AZ	US	Route 685 -Ajo\Gila Bend Connector	Gila Bend	Phoenix	No	No	Yes-Bus

Sample of Commuter Rail/Intercity Rai/Intercity Bus Data Collected – Transit Systems (Data collection is in progress)

Owner/Manager	Year Service Began	Length - One-way (mi)	No. of Stations Served	M-F Service?	No. of Peak Trips	No. of Off-Peak Trips	Saturday Service	No. of Saturday Trips	Sunday Service	No. of Sunday Trips	Annual Ridership	APTA 2011 Quarterly Weekday Ridership (Average)	Avg Daily Ridership (Weekday)	Avg Daily Ridership (Saturday)	Avg Daily Ridership (Sunday)	Avg Daily Ridership (Weekend)	Parallel Interstate	Work trips in Corridor	Note
COMMUTER RAIL SERVICES																			
Denton County Transportation Authority	Jun-11	21	6	Yes	14 (IB) / 14 (OB)	9 (IB) / 8 (OB)	Yes	10 (IB) / 10 (OB)	No	N/A		5,100			N/A		I-35E	31,000	Provides a connection to DART Green Line; Does not travel to downtown Dallas
Capital Metropolitan Transportation Authority	Mar-10	32	9	Yes	5 (IB) / 5 (OB)	10 (IB) / 10 (OB)	No	N/A	No	N/A		1,800	1,750	N/A	N/A	N/A	US-183/I-35	82,300	
Utah Transit Authority	Apr-08	45	7	Yes	16 (IB) / 18 (OB)	13 (IB) / 11 (OB)	Yes	17 (IB) / 17 (OB)	No	N/A		5,700			N/A		I-15	36,200	
Tennessee Department of Transportation	Sep-06	32	6	Yes	6 (IB) / 6 (OB)	N/A	No	N/A	No	N/A		1,100					I-40	44,000	
North County Transit District	Feb-95	41	8	Yes	9 (SB) / 9 (NB)	2 (SB) / 2 (NB)	Yes	6 (SB) / 6 (NB)	Yes	4 (SB) / 4 (NB)		5,400	4,800				I-5	46,200	
NMDOT & Mid Region Council of Governments	Jul-06	97	13	Yes	6 (SB) / 7 (NB)	4 (SB) / 3 (NB)	Yes	5 (SB) / 5 (NB)	Yes	3 (SB) / 3 (NB)		4,200	4,500				I-25	48,850	
Metropolitan Council (Rolling Stock) / BNSF (Infrastructure)	Nov-09	40	6	Yes	6 (NB) / 6 (SB)	N/A	Yes	3 (NB) / 3 (SB)	Yes	3 (NB) / 3 (SB)		2,300	2,600				I-94/US-10	96,950	
Dallas Area Rapid Transit & Ft. Worth Transportation Authority	Dec-96	34	10	Yes	13 (EB) / 15 (WB)	9 (EB) / 10 (WB)	Yes	9 (EB) / 10 (WB)	No	N/A	2,500,000	8,400	8,680	4,514	N/A	4,514	I-30	82,000	
Tri-County Metropolitan Transportation District of Oregon (TriMet)	Feb-09	14.7	5	Yes	16 (IB) / 16 (OB)	N/A	No	N/A	No	N/A		1,600	1,608	N/A	N/A	N/A	I-5/Hwy 217	133,000	
INTERCITY BUS SERVICES																			
New Mexico Department of Transportation		45		Yes	9 (IB) / 10 (OB)	N/A	No	N/A	No	N/A	33,000	N/A	125	0	0	0	I-10	8,900	
Jefferson Lines		179		Yes	3 (IB) / 3 (OB)	N/A	No	N/A	No	N/A	19,700	N/A	75	0	0	0	I-35/I-35W	3,700	
Department of Transportation and Development		80		Yes	8 (IB) / 8 (OB)	N/A	No	N/A	No	N/A	119,000	N/A	451	0	0	0	I-10	13,900	
Route 685		40		Yes	5 (IB) / 5 (OB)	N/A	No	N/A	No	N/A	14,600	N/A	130	0	0	0	MC-85	1,000	
Route 685		69		Yes	5 (IB) / 5 (OB)	N/A	Yes	2 (IB) / 2 (OB)	No	N/A	14,600	N/A	102	0	0	0	MC-85	9,500	

APPENDIX B: Level 1 Demand Assessment

Level 1 Demand Assessment

The AZTDM-2 travel forecasting model was used to identify future travel markets between project defined districts in the APRCS study area. In general, the data indicate strong travel markets between the Tucson urban area districts and the Phoenix urban area districts. A summary of the potential intercity and commuter markets is presented in Table B-1 below. The projected 2015 and 2035 desire lines are illustrated in Figures B-1 and B-2 respectively.

Table B-1: Potential Intercity[2] and Commuter[3] Markets

Distinct Pair	2015 - Projected Daily Person Trips	2035 - Projected Daily Person Trips	Market Type	Market Area
Tucson - Inside Loop 101[A]	10k - 20k	20k – 100k	Intercity	Tucson - Phoenix
Tucson - East Valley	4k - 6k	6k - 10k	Intercity	Tucson - Phoenix
Tucson - South Mountain	< 2k	2k - 4k	Intercity	Tucson - Phoenix
Marana - Inside Loop 101	< 2k	4k - 6k	Intercity	Tucson - Phoenix
South Tucson - Inside Loop 101	2k - 4k	2k - 4k	Intercity	Tucson - Phoenix
Apache Junction - East Valley	20k – 100k	> 100k	Commuter	Pinal County to Phoenix
Apache Junction - Inside Loop 101	6k - 10k	6k - 10k	Commuter	Pinal County to Phoenix
San Tan - Inside 101	2k - 4k	4k - 6k	Commuter	Pinal County to Phoenix
San Tan - East Valley	20K - 100k	20K - 100k	Commuter	Pinal County to Phoenix
Casa Grande - East Valley	2K - 4k	4k - 6k	Commuter	Pinal County to Phoenix
East Valley - Inside Loop 101	> 100k	> 100k	Commuter	Phoenix Urban Area
South Mountain - Inside Loop 101	> 100k	> 100k	Commuter	Phoenix Urban Area
Marana - Tucson	> 100k	> 100k	Commuter	Tucson Urban Area
South Tucson - Tucson	> 100k	> 100k	Commuter	Tucson Urban Area
South Tucson - Marana	6k - 10k	6k - 10k	Commuter	Tucson Urban Area
Oracle Junction - Tucson	2k - 4k	4k - 6k	Commuter	Pinal County to Tucson
Oracle Junction - Marana	6k - 10k	6k - 10k	Commuter	Pinal County to Tucson

Source: AZTDM-2
[A]Inside Loop 101 includes the Phoenix CBD, Sky Harbor Airport, and Arizona Statue University main and downtown campuses

[2] For Level 1 analysis, intercity demand is generally defined as demand between the Tucson and Phoenix urban areas.
[3] For Level 1 analysis, commuter demand is generally defined as demand between Pinal County districts and the Tucson and Phoenix urban areas and demand within the Tucson and Phoenix urban areas.

Figure B-1: 2015 Projected Daily Person Trips in Study Area

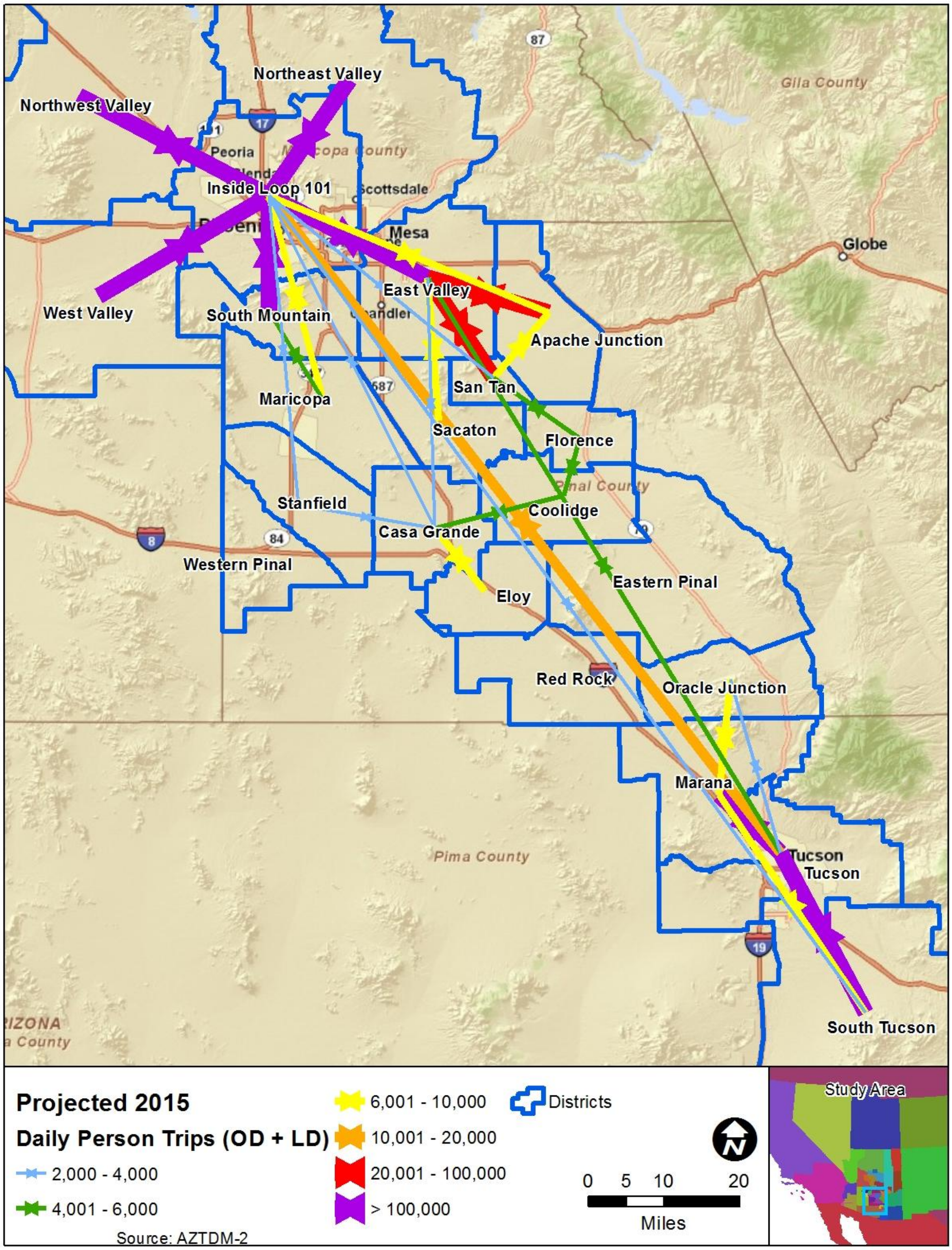


Figure B-2: 2035 Projected Daily Person Trips in Study Area